Remarks

Reconsideration and reexamination of the above-identified patent application, as amended, are respectfully requested. Claims 1-3, 6-7, 9-13, and 16-19 are pending in this application upon entry of this Amendment. In this Amendment, the Applicant has amended claims 1, 6-7, 9-11, and 16-19; and cancelled claim 20. No claims have been added in this Amendment. Of the pending claims, claims 1 and 11 are the only independent claims.

Claim Objections

In the final Office Action mailed November 2, 2004, the Examiner objected to claims 1, 6-7, 9-11, and 16-20 for various informalities. In response, the Applicant has amended claims 1, 6-7, 9-11, and 16-19 to correct the noted informalities.

Claim Rejections - 35 U.S.C. § 112

The Examiner rejected claim 20 under 35 U.S.C. § 112, 2nd paragraph, as being indefinite. In response, the Applicant has cancelled claim 20 in view of the amendment restrictions currently in place because of the after final stage of this application.

Claim Rejections - 35 U.S.C. §103

The Examiner rejected claims 1-3, 6, 11-13, and 16 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,977,732 issued to Matsumoto ("Matsumoto") in view of U.S. Patent No. 3,935,512 issued to Falk et al. ("Falk") and further in view of U.S. Patent No. 6,038,532 issued to Kane et al. ("Kane"). The Applicant respectfully traverses this rejection and believes that these claims as amended are patentable under 35 U.S.C. § 103(a) over Matsumoto, Falk, and Kane.

1. The Claimed Invention

The claimed invention as recited in amended independent claims 1 and 11 is directed to a method for determining a frequency of current ripples contained in an armature current signal of a commutated DC motor.

As recited in representative amended independent claim 1, the method includes determining (i) a frequency spectral result of the armature current signal of the motor in which the armature current signal contains current ripples and interference; and determining (ii) a frequency spectral result of a voltage signal of the motor in which the voltage signal contains the interference. A frequency spectral result of the current ripples contained in the armature current signal is then determined based on differences between (i) the frequency spectral result of the armature current signal and (ii) the frequency spectral result of the motor voltage signal such that the determined frequency spectral result of the current ripples contained in the armature current signal is void of frequency components which are superimposed on the armature current signal as the interference. The frequency of the current ripples contained in the armature current signal is then determined from the determined frequency spectral result of the current ripples contained in the armature current signal.

2. Matsumoto, Falk, and Kane

A. Matsumoto

The Examiner posited that Matsumoto discloses a method for determining a frequency of current ripples contained in an analog armature current signal of a DC motor (citing col. 6, lines 31-32 and 60) comprising:

determining an armature current signal (citing col. 6, lines 34-37; col. 7, lines 20-21); and

determining a result of the current ripples contained in the armature current signal based on the armature current signal and determining a current ripple frequency from

the current ripples contained in the armature current signal, without filtering (citing col. 7, lines 18-21).

As such, the Examiner posited that Matsumoto teaches determining current ripples in an armature current signal and determining a frequency of the current ripples. The Examiner noted that Matsumoto does not include means for removing interference from the armature current signal using a voltage signal that contains the interference.

B. Falk

The Examiner posited that Falk discloses a circuit for the compensation of current interference signals including means for:

determining a useful part of a current signal (citing col. 3, lines 58-66) by sensing a current signal containing a useful part and interference (citing col. 3, lines 1-9);

obtaining a voltage signal that contains the interference (citing col. 3, lines 14-21); and

subtracting the voltage signal from the current signal to result in the current signal void of interference (citing col. 3, lines 30-34).

The Examiner posited that it would have been obvious to modify Matsumoto to include means for removing interference from the armature current signal using a voltage signal that contains the interference because it is well known that an armature current signal contains interference and, as suggested by Falk, the combination would have provided means for removing the interference to improve the detection of the ripple component by distinguishing the part of the signal that is representative of the device operation from disturbances caused by a source (citing col. 1, lines 61-66 of Falk).

As such, the Examiner noted that the modification of Matsumoto and Falk includes subtracting a noise component represented by a voltage signal from an armature

current signal to determine the resulting current ripple, but does not teach performing the subtraction digitally to using a Fourier transform.

C. Kane

The Examiner posited that Kane discloses a signal processing device for cancelling noise in a signal including means for:

sensing an analog signal containing both a useful signal component and a noise component (citing col. 2, lines 38-41);

digitizing the analog signal (citing col. 2, lines 42-44);

determining a frequency spectral result of the digitized signal using a fast Fourier transform (citing col. 2, lines 45-48); and

cancelling the noise component of the signal by subtracting a noise prediction signal (citing col. 3, lines 26-32).

The Examiner posited that it would have been obvious to modify the modification of Matsumoto and Falk to include performing the subtraction digitally using a Fourier transform, as taught by Kane, because Kane suggests a method for frequency analysis that is well known in the art to provide the user with easier mathematical analysis and more accurate analysis due to the signals being better defined in classical mathematical signal processing terms and, as suggested by Kane, provides better interference elimination by completely eliminating the noise through clearly defined spectral frequencies (citing col. 3, lines 28-43).

3. The Claimed Invention Compared to Matsumoto, Falk, and Kane

The claimed invention as recited in amended independent claims 1 and 11 generally differs from any combination of Matsumoto, Falk, and Kane in that in the claimed invention a frequency spectral result of the current ripples contained in an armature current signal is determined from differences between (i) a frequency spectral result of the armature

current signal of the motor in which the current signal contains current ripples and interference and (ii) a frequency spectral result of a voltage signal of the motor in which the voltage signal contains the interference such that the determined frequency spectral result of the current ripples contained in the armature current signal is void of frequency components which are superimposed on the current signal as the interference. The frequency of the current ripples contained in the armature current signal is then determined from the determined frequency spectral result of the current ripples contained in the armature current signal. That is, in the claimed invention, differences in the frequency spectral results of (i) the armature current signal of the motor and (ii) a voltage signal of the motor are used to determine the frequency of the current ripples contained in the armature current signal.

The Examiner posited that Falk discloses obtaining a voltage signal that contains the interference contained in a current signal, and subtracting the voltage signal from the current signal to result in the current signal void of interference. The Applicant notes that Falk discloses that the voltage signal (u_B) containing the interference is essentially obtained from a monitored current (i) of a circuit to be monitored (see col. 3, lines 1-21 of Falk); and the voltage signal (u_B) is subtracted from a current signal (u_i) that is the derivative of the monitored current (i) (see col. 3, lines 22-44 of Falk) to produce a "resultant superimposed signal, i.e. the useful signal" (see col. 3, lines 45-66 of Falk). The Applicant notes that it is not clear as to how Falk subtracts voltage and current signals from one another as posited by the Examiner as such signals are defined in different types of units (e.g., volts and amperes).

In any event, the claimed invention differs from Falk in that in the claimed invention characteristics of two signals (e.g., the armature current signal and a voltage signal of the motor) based on two different things (e.g., the armature current and a voltage of the motor) are compared to one another whereas in Falk characteristics of two signals (e.g., the voltage signal (u_B) and the derivative current signal (u_i)) based on the same thing (e.g., the monitored current (i)) are compared to one another. As such, modifying Matsumoto to include means for removing interference from the armature current signal using a voltage signal that contains the interference as taught by Falk does not result in the claimed invention because

such a modification would essentially include using a voltage signal that is based on the armature current signal. That is, the modification of Matsumoto as suggested by Falk would result in removing interference from the armature current signal using some form of the armature current signal itself (i.e., using a voltage signal which is based on the armature current signal). In contrast, the claimed invention removes interference from the armature current signal using a voltage signal of the motor.

Thus, the Applicant believes that amended independent claims 1 and 11 are patentable under 35 U.S.C. § 103(a) over Matsumoto, Falk, and Kane. Claims 2-3, 6, 12-13, and 16 depend from one of amended independent claims 1 and 11 and include the limitations therein. Therefore, the Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1-3, 6, 11-13, and 16 under 35 U.S.C. § 103(a).

The Examiner rejected claim 20 under 35 U.S.C. § 103(a). As indicated above, the Applicant has cancelled claim 20.

The Examiner rejected claims 7, 9-10, and 17-19 under 35 U.S.C. § 103(a) as being unpatentable over Matsumoto in view of Falk and Kane and further in view of U.S. Patent No. 4,952,854 issued to Periou et al. Claims 7, 9-10, and 17-19 depend from one of amended independent claims 1 and 11 and include the limitations therein. Therefore, the Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 7, 9-10, and 17-19 under 35 U.S.C. § 103(a).

CONCLUSION

In summary, claims 1-3, 6-7, 9-13, and 16-19, as amended, meet the substantive requirement for patentability. The case is in appropriate condition for allowance. Accordingly, such action is respectfully requested.

If a telephone or video conference would expedite allowance or resolve any further questions, such a conference is invited at the convenience of the Examiner.

Respectfully submitted,
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